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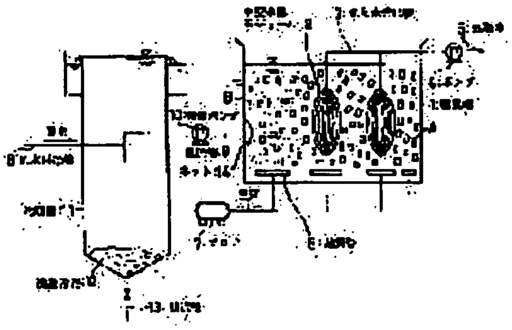
(54) HOLLOW FIBER MEMBRANE SEPARATION BIOLOGICAL TREATMENT AND DEVICE FOR ORGANIC DRAINAGE

(57)Abstract:
PURPOSE: To prevent the adhesion and solidification and press densification of sludge to membrane, keep the surface clean at all times and eliminate the necessity of maintenance work by coexisting biological granular solids in an aeration tank, keeping the solids in the suspension flowing state by aeration and discharing treated water through a hollow fiber membrane.
CONSTITUTION: In the hollow fiber membrane separation biological treatment method, urethane foam square grains A, the gravity of which is almost equal to that of water, are fed into an aeration tank 1, and microbes such as BOD utilized bacteria are carried on microbe carriers composed of the grains A. Also water to be treated in the tank 1 is disturbed by diffused air exhausted from an air blower 7 through an air diffusion pipe 6, and the grains A are suspension flowed by the turbulence generated by the diffused air. A membrane module 2 fitted with hollow fiber membrane is immersed in the tank 1, and the water treated biologically in the tank 1 is sucked by a pump 4, passed through the membrane module 2, filtered by the hollow fiber membrane fitted thereon and flowed out of a treated water outflow pipe 3 in the form of cleaing treated water 5 completely free from SS.



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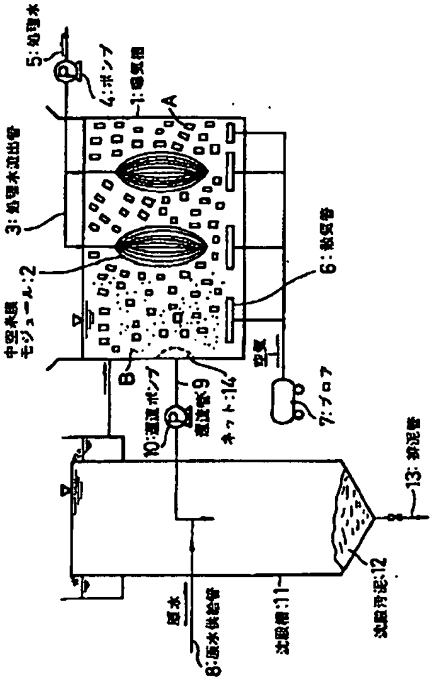
(54)【発明の名称】　有機性排水の中空糸膜分離生物処理方法および装置

(57)【要約】

【目的】　膜への汚泥の付着、固着圧密化を防止し、常に膜表面を清浄に保てる新技術を確立し、膜を取り出して行う清掃作業を不要にできる画期的技術を提供すること。

【構成】　有機性排水を沈降により固液分離せしめた後、中空糸膜を浸漬した曝気槽内に供給して生物処理ならびに膜分離しつつ、該曝気槽内の液を前記沈降分離工程に還流すると共に、前記曝気槽内に生物付着粒状固体を共存させ、曝気によって該粒状固体を懸濁流動状態に置き、前記中空糸膜を通して処理水を取り出すことを特徴とする中空糸膜分離生物処理方法およびその装置。



【特許請求の範囲】

【請求項１】　有機性排水を沈降により固液分離せしめた後、中空糸膜を浸漬した曝気槽内に供給して生物処理ならびに膜分離しつつ、該曝気槽内の液を前記沈降分離工程に還流すると共に、前記曝気槽内に生物付着粒状固体を共存させ、曝気によって該粒状固体を懸濁流動状態に置き、前記中空糸膜を通して処理水を取り出すことを特徴とする中空糸膜分離生物処理方法。

【請求項２】　有機性排水の沈澱槽と曝気槽を有し、該沈澱槽処理水を前記曝気槽に導く配管、および前記曝気槽内の水を前記沈澱槽に返送する配管を有すると共に、前記曝気槽には曝気手段の他曝気槽内の水をろ過する中空糸膜固液分離装置を配備し、さらに生物付着粒状固体を前記曝気槽内水中に浮遊共存させたことを特徴とする中空糸膜分離生物処理装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、下水など各種有機性汚水を微生物と中空糸膜分離によって高度に浄化する方法および装置に関するものである。

【０００２】

【従来の技術】従来より活性汚泥の曝気槽内に中空糸膜の膜分離モジュールを浸漬し、浮遊微生物（活性汚泥フロック）によってＢＯＤを除去しつつ、膜によって微生物その他のＳＳを完全にろ過分離し、清澄処理水を得る技術が公知である。しかし本発明者が、この従来技術による下水など有機性汚水の処理を行ったところ、中空糸膜の表面または膜の束の間に活性汚泥が強く付着し、付着した汚泥が脱水されるため、ケーキ状となってますます強固にこびりつくという重大な欠点があることが認められた。この現象は、活性汚泥のＭＬＳＳ濃度が増加するほど顕著になることもわかった。こうなってしまうと膜のろ過抵抗が急増し、運転不能になる。しかし曝気槽内に浸漬したまま膜をクリーニングすることは不可能であり、膜モジュールを外に取り出して、高圧スプレー水を噴射しながら、膜に付着した汚泥を除去しなければならない。この作業は極めて面倒な作業であり、膜モジュールが多数ある場合などは数日がかりの大作業となる。実際上、このようなことは不可能である。

【０００３】

【発明が解決しようとする課題】本発明者は、従来技術により曝気槽内の有機性汚水中に含まれるＢＯＤなどを生物処理により除去しつつ、分離膜によって浮遊活性汚泥などをろ過分離し、清澄処理水を得る処理を実施し、問題点の生じる原因を詳しく検討した結果から次の知見を得た。

１）曝気槽内の浮遊活性汚泥濃度が高濃度になるほど、膜への汚泥の付着、圧密化が起き易い。

２）曝気槽内の浮遊活性汚泥濃度が数百ミリグラム／リットル以下ならば分離膜への汚泥の付着は著しく少なくなる。

本発明は前記従来装置の重大欠点を完全に解決し、膜の取り出し、清掃作業を不要にできる画期的技術を提供するものである。具体的には、膜への汚泥の付着、固着圧密化を防止し、常に膜表面を清浄に保てる新技術を確立し、メンテナンス作業の不要化を図るものである。

【０００４】

【課題を解決するための手段】本発明は、上記新知見に次の新たな着想を統合して完成されたものである。すなわち、（１）有機性排水を沈殿槽に導いて、汚泥などを沈降により固液分離せしめた後、中空糸膜を浸漬した曝気槽内に供給して、生物処理ならびに膜分離しつつ、該曝気槽内の液を前記沈降分離工程に還流すると共に、前記曝気槽内に生物付着粒状固体を共存させ、曝気によって該粒状固体を懸濁流動状態に置き、前記中空糸膜を通して処理水を取り出すことを特徴とする中空糸膜分離生物処理方法。および、（２）有機性排水の沈澱槽と曝気槽を有し、該沈澱槽処理水を前記曝気槽に導く配管、および前記曝気槽内の水を前記沈澱槽に返送する配管を有すると共に、前記曝気槽には曝気手段の他曝気槽内の水をろ過する中空糸膜固液分離装置を配備し、さらに生物付着粒状固体を前記曝気槽内水中に浮遊共存させたことを特徴とする中空糸膜分離生物処理装置である。

【０００５】中空糸膜を装填した膜分離モジュールを浸漬させた曝気槽内に、流動し易い微生物固定化担体粒子を懸濁流動させて処理を行い、槽内の微生物濃度を高く維持しつつ、曝気槽内液を前段の沈殿槽に循環させることによって、浮遊微生物を沈降分離し、浮遊状の微生物（担体に付着していない微生物）濃度を数百ミリグラム／リットル以下に維持でき、しかも微生物固定化担体粒子が中空糸膜の表面と接触する時に、膜の表面をクリーニングするという重要な効果が得られた。この結果、膜に活性汚泥が付着圧密化することがなくなり、膜を槽外に取り出して清掃するという作業が要らなくなることが判明した。

【０００６】微生物固定化担体粒子としては、軽く、流動し易いもの、微生物固定化能力が大きいこと、膜と接触するときの膜の清掃作用が大きいものが好適であり、これらの条件を満足する粒状物としては、プラスチック担体や、軽量のゼオライトなど鉱物、軽量骨材などの無機多孔性担体や、紐（繊維）状物の短束状物または塊状物など、あるいはゲル包括微生物担体その他種々公知の担体が使えるが、特に目の大きな立体網目構造の粒状ろ材が好適な担体粒状物である。

【０００７】上記立体的網目状粒状体ろ材は、表面から内部にかけて連続した穴を持つように形成され、公知の発泡法等により製造できる。また、粒状体の素材としては、上記性質を有するものであるならば特に制限されず、有機高分子、無機化合物等公知のものを使用できるが、中でも素材自体に適度な弾性と強度とを有する素材

が好ましく、特にウレタン樹脂等が好ましい。例えば、ポリウレタンフォーム等の弾性多孔性粒状物を、ウレタン樹脂等のプラスチックスを連続気泡を造る発泡法で発泡して作製して、そのまま使用するか所望の形状、サイズに切断して使用する。

【０００８】その形状は角形、球状、その他種々の形状がとれるが、角形が好ましい。　特に形状が角状で、粒径が１０×１０×１０ｍｍ位のサイコロ状あるいは１０×２０×２０ｍｍの直方体、１０×３０×３０ｍｍの直方体などが好適である。　粒状物の粒径があまり小粒径であると、分離膜表面の清掃力が小さくなり、あまり大粒径であると微生物の固定化量が少なくなり、粒状物内部が腐敗し易いので好ましくない。その素材の比重は、通常０．９〜１．２程度が好ましい。また空隙率は、９０％以上が好ましい。気孔径、即ち、孔径は、０．１〜６ｍｍ、好ましくは２〜４ｍｍの範囲から選択することが望ましい。また、１ｃｍ長さ当たりの孔の数は、５〜２０個が好ましい。

【０００９】曝気槽内に投入する量としては、ポリウレタンフォーム製の粒径１０×２０×２０ｍｍの直方体粒状物を使用する場合、曝気槽１ｍ^3 あたり２０〜３０Ｖ／Ｖ％が適当であり、あまりぎっしりと投入しすぎると担体が流動し難くなり、本発明の目的を達成できない。また、少なすぎると微生物濃度を高く保てない。本発明によって処理を続けると、微生物が繁殖し、その一部は微生物固定化担体に保持され、一部は浮遊微生物となって曝気槽内を浮遊するがこの浮遊微生物は前段の沈殿槽に供給されて沈降分離される。従って、処理を長時間続けても、曝気槽内の浮遊微生物濃度が増加しないので、中空糸膜への汚泥固着トラブルが発生しない。

【００１０】

【実施例】次に本発明の代表的実施例を図１に基づいて説明する。

【００１１】（実施例１）以下に本発明の脱リン材の製造方法を詳しく説明する。１は本発明の曝気槽であり、曝気槽１内には、比重が水にほぼ等しい図２に示すウレタンフォーム角状粒状物Ａが投入されており、これら粒状物Ａからなる微生物担体にはＢＯＤを資化するＢＯＤ資化菌などの微生物が保持されている。空気源である空気ブロワー７から散気管６を経て曝気槽１内に吐出される散気空気によって槽１内の被処理水は攪乱されている。上記微生物を保持しているウレタンフォーム角状粒状物Ａは、上記散気空気が引き起こす乱流によって懸濁流動している。また、曝気槽１内には中空糸膜を装填した膜モジュール２が浸漬されており、曝気槽１内で生物学的に処理された処理水はポンプ４によって吸引されて膜モジュール２を通り、膜モジュール２に装填した膜によってろ過されて処理水流出管３を通り、ＳＳゼロの清澄処理水５となって、系外に流出して行く。

【００１２】図１にＢで示したものは、ポリウレタンフォーム角状粒状物Ａからなる担体に付着していない曝気槽１内の被処理水中に浮遊している浮遊微生物である。これら浮遊微生物Ｂは還流ポンプ１０によって被処理水と共に還流管９を通って沈殿槽１１に還流される。またこの沈殿槽１１には外部から下水など原水が原水流入管８を通って流入する。上記還流ポンプ１０によって曝気槽１内の被処理水は浮遊微生物Ｂを伴って沈殿槽１１に還流するが、その際生物処理水中に懸濁流動している粒状物Ａが流出しないように目の大きいネット１４が排出管９の入口に張設してある。このネットは多孔板やスリットなど通水性のものであれば何でも良い。また図１において、１２は沈殿槽１１の底部に沈殿した沈殿汚泥であり、１３は沈殿汚泥１２を排出する排泥管である。

【００１３】下水などの原水を本発明の方法で処理を行った結果、ポリウレタンフォーム角状粒状物Ａには１５０００〜２００００ｍｇ／リットルもの高濃度の微生物が保持され、浮遊微生物を数百ミリグラム／リットルの濃度と低く見積もっても、極めて高度に原水が浄化されることが認められる。本発明の生物処理装置は１年間連続運転しても、汚泥が中空糸モジュール２に装填した膜の表面に固着したり、汚泥が中空糸の束に食い込んでろ過抵抗を急上昇させたりするトラブルは発生しなかった。また、本発明の曝気槽１での生物処理工程では原水中に毛髪、ビニール片などの夾雑物が含まれていると、これらが粒状物Ａや中空糸モジュール２に絡みつきトラブルとなるが、本発明では、予め沈殿槽１１で夾雑物を除去できるのでこのようなトラブルを防止できる。

【００１４】（比較例１）比較例として、生物処理槽１中にポリウレタンフォーム角状粒状物Ａからなる微生物担体を投入せず、また曝気槽内の被処理水を還流させることなく、曝気槽内の浮遊微生物の濃度を１８０００ｍｇ／リットルに維持して原水の生物学的処理を行ったところ、中空糸膜の表面に汚泥が固着して、ほぼ１５〜２０日に１回の頻度で中空糸膜のろ過抵抗が急上昇し、その度に中空糸モジュール２を取り外し人手で中空糸膜の糸を一本一本ほぐしながら中空糸膜に付着・固着した汚泥を洗浄しなければならなかった。

【００１５】

【発明の効果】本発明の生物処理装置とそれを使用した生物処理方法の実施により、以下に示す極めて大きな効果が得られる。

①中空糸膜の表面などに微生物汚泥が固着することがないので、中空糸モジュールのろ過抵抗を低く保つことができ、中空糸膜を取り外して洗浄する必要がない。従って、著しく生物処理装置のメンテナンスが容易である。

②微生物濃度を高めても中空糸膜への微生物汚泥が固着を防ぐことができるので、生物反応速度を大きくでき、生物処理装置をコンパクト化できる。

【図面の簡単な説明】

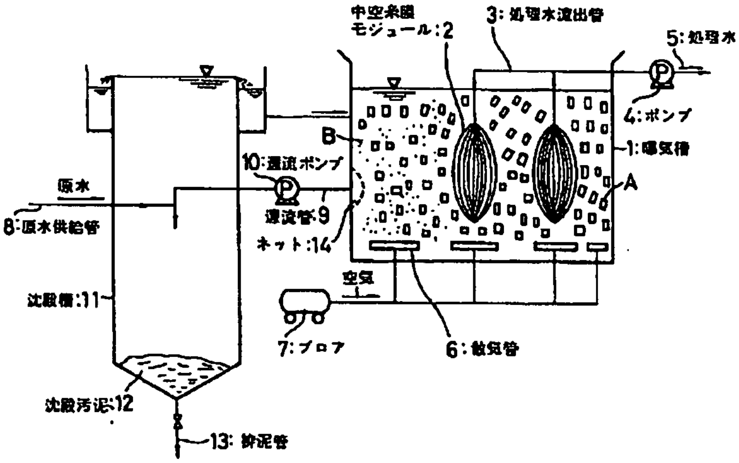
【図１】本発明の生物処理装置の１例を示す模式図。

【図２】本発明の生物処理に使用する粒状微生物担体の１例を示す斜視図。

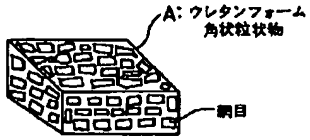
【符号の説明】

1	曝気槽
2	中空糸膜モジュール
3	処理水流出管
4	ポンプ
5	処理水
6	散気管
7	空気源（ブロワー）
8	原水供給管
9	被処理水還流管
10	還流ポンプ
11	沈殿槽
12	沈殿汚泥
13	排泥管
14	ネット
A	ウレタンフォーム角状粒状物
B	浮遊微生物

【図１】



【図２】



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CLAIMS

[Claim(s)]

[Claim 1] The hollow fiber part separate object art which supplies a hollow fiber in the immersed aerator and is characterized by biological treatment and making a living thing adhesion granular solid-state live together in said aerator, putting this granular solid-state on a suspension flow condition by aeration, and taking out treated water through said hollow fiber while flowing back the liquid in this aerator at said sedimentation process, carrying out membrane separation after carrying out solid liquid separation of the organic waste water by sedimentation.

[Claim 2] The hollow fiber part separate object processor characterized by having arranged the hollow fiber solid-liquid separator which filters the water in the other aerators of an aeration means to said aerator, and carrying out suspension coexistence of the living thing adhesion granular solid-state all over said aerator inland water further while having the settling tank and aerator of organic waste water and having piping which leads this settling tank treated water to said aerator, and piping which returns the water in said aerator to said settling tank.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the approach and equipment which purify various organic nature sanitary sewage, such as sewage, to altitude according to hollow fiber separation with a microorganism.
[0002]
[Description of the Prior Art] The technique of carrying out filtration separation of the SS of a microorganism and others completely, and obtaining founding treated water with the film is well-known, the membrane-separation module of a hollow fiber being conventionally immersed in the aerator of active sludge, and an airborne microbe (active sludge flocks) removing BOD. However, since active sludge adhered strongly between the front face of a hollow fiber, or a membranous bundle and adhering sludge was dehydrated when this invention person processes organic nature sanitary sewage, such as sewage by this conventional technique, it was admitted that there was a serious fault of becoming cake-like and sticking firmly increasingly. It also turned out that this phenomenon becomes so remarkable that the MLSS concentration of active sludge increases. If it becomes like this, membranous filtration resistance will increase rapidly and it will become operation impossible. However, the sludge adhering to the film must be removed, taking out a membrane module outside and injecting [it is impossible to clean the film, while it had been immersed in the aerator, and] high-pressure spray water. This activity is a very troublesome activity, and when a large number [a membrane module], it becomes the great work business on several. In practice, such a thing is impossible.
[0003]
[Problem(s) to be Solved by the Invention] Removing BOD contained in the organic nature sanitary sewage in an aerator by the conventional technique by biological treatment, he did filtration separation of the suspension active sludge etc. by the demarcation membrane, and carried out processing which obtains founding treated water, and this invention person acquired the following knowledge from the result of having considered in detail the cause which a trouble produces.
1) Adhesion of sludge on the film and a consolidation tend to occur, so that the suspension active sludge concentration in an aerator turns into high concentration.
2) If the suspension active sludge concentration hundreds of mg [/] or less in an aerator becomes l., adhesion of the sludge to a demarcation membrane will decrease remarkably.
This invention solves the serious fault of equipment completely conventionally [said], and offers the epoch-making technique which can make membranous ejection and cleaning unnecessary. Specifically adhesion of sludge on the film and a fixing consolidation are prevented, the new technique which can always maintain a film front face at clarification is established, and unnecessary-ization of a maintenance is attained.
[0004]
[Means for Solving the Problem] This invention unifies the following new idea in the above-mentioned new knowledge, and is completed. Namely, supplying a hollow fiber in the immersed aerator and carrying out membrane separation to a biological treatment row, after leading (1) organic waste water to the setting tank

and carrying out solid liquid separation of the sludge etc. by sedimentation, while flowing back at said sedimentation process, the liquid in this aerator The hollow fiber part separate object art characterized by making a living thing adhesion granular solid-state live together in said aerator, putting this granular solid-state on a suspension flow condition by aeration, and taking out treated water through said hollow fiber. And while having the settling tank and aerator of (2) organic waste water and having piping which leads this settling tank treated water to said aerator, and piping which returns the water in said aerator to said settling tank, it is the hollow fiber part separate object processor characterized by having arranged the hollow fiber solid-liquid separator which filters the water in the other aerators of an aeration means to said aerator, and carrying out suspension coexistence of the living thing adhesion granular solid-state all over said aerator inland water further.

[0005] By making the setting tank of the preceding paragraph circulate through the liquid in an aerator, processing by carrying out a suspension flow of the microorganism immobilization support particle which is easy to flow, and maintaining the microorganism concentration in a tub highly in the aerator in which the membrane-separation module loaded with the hollow fiber was made immersed When an airborne microbe was sedimented, the microorganism (microorganism which has not adhered to support) concentration of the letter of suspension was able to be maintained [l.] in hundreds of mg /or less and a microorganism immobilization support particle moreover contacted the front face of a hollow fiber, the important effectiveness of cleaning a membranous front face was acquired. Consequently, it was lost that active sludge carries out an adhesion consolidation to the film, and it became clear that it stopped needing the activity of taking out and cleaning the film out of a tub.

[0006] As a microorganism immobilization support particle, it is light and the thing and microorganism fixed capacity which are easy to flow are large, As a granular object with which what has a large cleaning operation of the film when contacting the film is suitable for, and satisfied of these conditions gel comprehension microorganism support, such as inorganic porosity support, such as plastics support, and minerals, such as a lightweight zeolite, a lightweight aggregate, and a short bundle of a string (fiber)-like object or a massive object, and other versatility -- although well-known support can be used, the granular filter media of framework structure especially with a big eye are suitable support granular objects.

[0007] The above-mentioned three-dimensional mesh-like granule filter media are formed so that it may have the hole which applied and followed the interior from the front face, and they can be manufactured by the well-known foaming method etc. Moreover, although it will not be restricted as a material of a granule especially if it has the above-mentioned property, but well-known things, such as an organic macromolecule and an inorganic compound, can be used, especially, the material which has moderate elasticity and reinforcement for the material itself is desirable, and urethane resin etc. is especially desirable. For example, by the foaming method which builds an open cell, it foams to plastics, such as urethane resin, they are produced, and are used as they are, or elastic porosity granular objects, such as polyurethane foam, are cut and used for a desired configuration and size.

[0008] Although the configuration can take a square shape and configurations a globular shape and various [other], its square shape is desirable. Especially a configuration is corniform and the about 10x10x10mm shape of a die, a 10x20x20mm rectangular parallelepiped, a 10x30x30mm rectangular parallelepiped, etc. are suitable for particle size. Since the cleaning force on the front face of a demarcation membrane becomes it small that the particle size of a granular object is a diameter of a granule not much, the amount of immobilization of a microorganism decreases that it is a diameter of a large drop not much and it is easy to decompose the interior of a granular object, it is not desirable. As for the specific gravity of the material, 0.9 to about 1.2 are usually desirable. Moreover, 90% or more of voidage is desirable. As for a pore diameter, i.e., an aperture, it is preferably desirable to choose from the range of 2-4mm 0.1-6mm. Moreover, the number of the holes per 1cm die length has 5-20 desirable pieces.

[0009] As an amount supplied in an aerator, when using a rectangular parallelepiped granular object with a particle size [made from polyurethane foam] of 10x20x20mm, it is 3 1m of aerators. If hits 20-30v/V% is suitable and supplies too much not much tightly, support stops being able to flow easily and the purpose of this invention cannot be attained. Moreover, microorganism concentration cannot be kept high if too few. If

processing is continued by this invention, a microorganism breeds, that part is held at microorganism immobilization support, and although a part serves as an airborne microbe and the inside of an aerator is floated, the sedimentation of this airborne microbe will be supplied and carried out to the setting tank of the preceding paragraph. Therefore, since the airborne microbe concentration in an aerator does not increase even if it continues processing for a long time, the sludge fixing trouble to a hollow fiber does not occur.
[0010]
[Example] Next, the typical example of this invention is explained based on drawing 1 .
[0011] (Example 1) The manufacture approach of the dephosphorylation material of this invention is explained in detail below. 1 is the aerator of this invention, in the aerator 1, the urethane foam corniform granular object A shown in drawing 2 with specific gravity almost equal to water is thrown in, and microorganisms, such as a BOD utilization bacillus which carries out utilization of the BOD to the microorganism support which consists of these granular objects A, are held. The processed water in a tub 1 is disturbed by the aeration air breathed out in an aerator 1 through the powder trachea 6 from the air blower 7 which is an air supply. The urethane foam corniform granular object A holding the above-mentioned microorganism is carrying out a suspension flow by the turbulent flow which the above-mentioned aeration air causes. Moreover, in the aerator 1, it is immersed in the membrane module 2 loaded with the hollow fiber, and the treated water biologically processed within the aerator 1 is attracted by the pump 4, and it passes along a membrane module 2, it is filtered with the film with which the membrane module 2 was loaded, passes along the treated water excurrent canal 3, it becomes founding treated water 5 of SS zero, and flows out and goes out of a system.
[0012] What was shown in drawing 1 by B is an airborne microbe which is floating to the processed underwater one in the aerator 1 which has not adhered to the support which consists of a polyurethane foam corniform granular object A. These airborne microbes B flow back to a setting tank 11 through the reflux tubing 9 with processed water with the reflux pump 10. Moreover, raw water, such as sewage, flows into this setting tank 11 through the raw water inhalant canal 8 from the exterior. Although the processed water in an aerator 1 flows back to a setting tank 11 with an airborne microbe B with the above-mentioned reflux pump 10, the large network 14 of an eye is stretched at the inlet port of an exhaust pipe 9 so that the granular object A which is carrying out a suspension flow may not flow into biological treatment underwater in that case. This network is good anything, if a perforated plate, a slit, etc. are the things of water flow nature. Moreover, in drawing 1 , 12 is precipitate sludge which precipitated at the pars basilaris ossis occipitalis of a setting tank 11, and 13 is sludge tubing which discharges precipitate sludge 12.
[0013] As a result of processing raw water, such as sewage, by the approach of this invention, the microorganism of 15000-20000mg [/l.] thing high concentration is held at the polyurethane foam corniform granular object A, and it is accepted to be an estimate in an airborne microbe as low as the concentration of hundreds of mg/l. that raw water is extremely purified by altitude. Even if it carried out continuous running of the biological treatment equipment of this invention for one year, sludge did not fix on the front face of the film with which the hollow fiber module 2 was loaded, and the trouble which sludge eats [trouble] into the bundle of a hollow filament and skyrockets filtration resistance was not generated. Moreover, at the biological treatment process in the aerator 1 of this invention, if impurity, such as hair and a piece of vinyl, is contained in raw water, these will get twisted around the granular object A and a hollow fiber module 2, and will serve as a trouble, but in this invention, since impurity is removable by the setting tank 11 beforehand, such a trouble can be prevented.
[0014] As an example of a comparison, the microorganism support which consists of a polyurethane foam corniform granular object A is not supplied in the biological treatment tub 1. (Example 1 of a comparison) Moreover, when the concentration of the airborne microbe in an aerator is maintained [l.] in 18000mg /and biological waste treatment of raw water is performed, without making the processed water in an aerator flow back, sludge fixes on the surface of a hollow fiber. Filtration resistance of a hollow fiber went abruptly up by 1 time of frequency on about 15 - the 20th, and the sludge which adhered and fixed had to be washed to the hollow fiber, having removed the hollow fiber module 2 to whenever [the], and unfolding one 1 yarn of a hollow fiber with a help to it.

[0015]

[Effect of the Invention] The very big effectiveness taken below is acquired by the biological treatment equipment of this invention, and operation of the biological treatment approach which used it.

** Since microorganism sludge does not fix on the surface of a hollow fiber etc., need to remove a hollow fiber and it is not necessary for filtration resistance of a hollow fiber module to be kept low, and to wash it. Therefore, the maintenance of biological treatment equipment is remarkably easy.

** Since the microorganism sludge to a hollow fiber can prevent fixing even if it raises microorganism concentration, a living thing reaction rate can be enlarged and biological treatment equipment can be miniaturized.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the approach and equipment which purify various organic nature sanitary sewage, such as sewage, to altitude according to hollow fiber separation with a microorganism.

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PRIOR ART

[Description of the Prior Art] The technique of carrying out filtration separation of the SS of a microorganism and others completely, and obtaining founding treated water with the film is well-known, the membrane-separation module of a hollow fiber being conventionally immersed in the aerator of active sludge, and an airborne microbe (active sludge flocks) removing BOD. However, since active sludge adhered strongly between the front face of a hollow fiber, or a membranous bundle and adhering sludge was dehydrated when this invention person processes organic nature sanitary sewage, such as sewage by this conventional technique, it was admitted that there was a serious fault of becoming cake-like and sticking firmly increasingly. It also turned out that this phenomenon becomes so remarkable that the MLSS concentration of active sludge increases. If it becomes like this, membranous filtration resistance will increase rapidly and it will become operation impossible. However, the sludge adhering to the film must be removed, taking out a membrane module outside and injecting [it is impossible to clean the film, while it had been immersed in the aerator, and] high-pressure spray water. This activity is a very troublesome activity, and when a large number [a membrane module], it becomes the great work business on several. In practice, such a thing is impossible.

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EFFECT OF THE INVENTION

[Effect of the Invention] The very big effectiveness taken below is acquired by the biological treatment equipment of this invention, and operation of the biological treatment approach which used it.
** Since microorganism sludge does not fix on the surface of a hollow fiber etc., need to remove a hollow fiber and it is not necessary for filtration resistance of a hollow fiber module to be kept low, and to wash it. Therefore, the maintenance of biological treatment equipment is remarkably easy.
** Since the microorganism sludge to a hollow fiber can prevent fixing even if it raises microorganism concentration, a living thing reaction rate can be enlarged and biological treatment equipment can be miniaturized.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Removing BOD contained in the organic nature sanitary sewage in an aerator by the conventional technique by biological treatment, he did filtration separation of the suspension active sludge etc. by the demarcation membrane, and carried out processing which obtains founding treated water, and this invention person acquired the following knowledge from the result of having considered in detail the cause which a trouble produces.
1) Adhesion of sludge on the film and a consolidation tend to occur, so that the suspension active sludge concentration in an aerator turns into high concentration.
2) If the suspension active sludge concentration hundreds of mg [/] or less in an aerator becomes l., adhesion of the sludge to a demarcation membrane will decrease remarkably.
This invention solves the serious fault of equipment completely conventionally [said], and offers the epoch-making technique which can make membranous ejection and cleaning unnecessary. Specifically adhesion of sludge on the film and a fixing consolidation are prevented, the new technique which can always maintain a film front face at clarification is established, and unnecessary-ization of a maintenance is attained.

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MEANS

[Means for Solving the Problem] This invention unifies the following new idea in the above-mentioned new knowledge, and is completed. Namely, supplying a hollow fiber in the immersed aerator and carrying out membrane separation to a biological treatment row, after leading (1) organic waste water to the setting tank and carrying out solid liquid separation of the sludge etc. by sedimentation, while flowing back at said sedimentation process, the liquid in this aerator The hollow fiber part separate object art characterized by making a living thing adhesion granular solid-state live together in said aerator, putting this granular solid-state on a suspension flow condition by aeration, and taking out treated water through said hollow fiber. And while having the settling tank and aerator of (2) organic waste water and having piping which leads this settling tank treated water to said aerator, and piping which returns the water in said aerator to said settling tank, it is the hollow fiber part separate object processor characterized by having arranged the hollow fiber solid-liquid separator which filters the water in the other aerators of an aeration means to said aerator, and carrying out suspension coexistence of the living thing adhesion granular solid-state all over said aerator inland water further.

[0005] By making the setting tank of the preceding paragraph circulate through the liquid in an aerator, processing by carrying out a suspension flow of the microorganism immobilization support particle which is easy to flow, and maintaining the microorganism concentration in a tub highly in the aerator in which the membrane-separation module loaded with the hollow fiber was made immersed When an airborne microbe was sedimented, the microorganism (microorganism which has not adhered to support) concentration of the letter of suspension was able to be maintained [l.] in hundreds of mg /or less and a microorganism immobilization support particle moreover contacted the front face of a hollow fiber, the important effectiveness of cleaning a membranous front face was acquired. Consequently, it was lost that active sludge carries out an adhesion consolidation to the film, and it became clear that it stopped needing the activity of taking out and cleaning the film out of a tub.

[0006] As a microorganism immobilization support particle, it is light and the thing and microorganism fixed capacity which are easy to flow are large, As a granular object with which what has a large cleaning operation of the film when contacting the film is suitable for, and satisfied of these conditions gel comprehension microorganism support, such as inorganic porosity support, such as plastics support, and minerals, such as a lightweight zeolite, a lightweight aggregate, and a short bundle of a string (fiber)-like object or a massive object, and other versatility -- although well-known support can be used, the granular filter media of framework structure especially with a big eye are suitable support granular objects.

[0007] The above-mentioned three-dimensional mesh-like granule filter media are formed so that it may have the hole which applied and followed the interior from the front face, and they can be manufactured by the well-known foaming method etc. Moreover, although it will not be restricted as a material of a granule especially if it has the above-mentioned property, but well-known things, such as an organic macromolecule and an inorganic compound, can be used, especially, the material which has moderate elasticity and reinforcement for the material itself is desirable, and urethane resin etc. is especially desirable. For example, by the foaming method which builds an open cell, it foams to plastics, such as urethane resin, they are produced, and are used as they are, or elastic porosity granular objects, such as polyurethane foam, are cut and used for a desired configuration and size.

[0008] Although the configuration can take a square shape and configurations a globular shape and various [other], its square shape is desirable. Especially a configuration is corniform and the about 10x10x10mm shape of a die, a 10x20x20mm rectangular parallelepiped, a 10x30x30mm rectangular parallelepiped, etc. are suitable for particle size. Since the cleaning force on the front face of a demarcation membrane becomes it small that the particle size of a granular object is a diameter of a granule not much, the amount of immobilization of a microorganism decreases that it is a diameter of a large drop not much and it is easy to decompose the interior of a granular object, it is not desirable. As for the specific gravity of the material, 0.9 to about 1.2 are usually desirable. Moreover, 90% or more of voidage is desirable. As for a pore diameter, i.e., an aperture, it is preferably desirable to choose from the range of 2-4mm 0.1-6mm. Moreover, the number of the holes per 1cm die length has 5-20 desirable pieces.

[0009] As an amount supplied in an aerator, when using a rectangular parallelepiped granular object with a particle size [made from polyurethane foam] of 10x20x20mm, it is 3 1m of aerators. If hits 20-30v/V% is suitable and supplies too much not much tightly, support stops being able to flow easily and the purpose of this invention cannot be attained. Moreover, microorganism concentration cannot be kept high if too few. If processing is continued by this invention, a microorganism breeds, that part is held at microorganism immobilization support, and although a part serves as an airborne microbe and the inside of an aerator is floated, the sedimentation of this airborne microbe will be supplied and carried out to the setting tank of the preceding paragraph. Therefore, since the airborne microbe concentration in an aerator does not increase even if it continues processing for a long time, the sludge fixing trouble to a hollow fiber does not occur.

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EXAMPLE

[Example] Next, the typical example of this invention is explained based on drawing 1 .
[0011] (Example 1) The manufacture approach of the dephosphorylation material of this invention is explained in detail below. 1 is the aerator of this invention, in the aerator 1, the urethane foam corniform granular object A shown in drawing 2 with specific gravity almost equal to water is thrown in, and microorganisms, such as a BOD utilization bacillus which carries out utilization of the BOD to the microorganism support which consists of these granular objects A, are held. The processed water in a tub 1 is disturbed by the aeration air breathed out in an aerator 1 through the powder trachea 6 from the air blower 7 which is an air supply. The urethane foam corniform granular object A holding the above-mentioned microorganism is carrying out a suspension flow by the turbulent flow which the above-mentioned aeration air causes. Moreover, in the aerator 1, it is immersed in the membrane module 2 loaded with the hollow fiber, and the treated water biologically processed within the aerator 1 is attracted by the pump 4, and it passes along a membrane module 2, it is filtered with the film with which the membrane module 2 was loaded, passes along the treated water excurrent canal 3, it becomes founding treated water 5 of SS zero, and flows out and goes out of a system.
[0012] What was shown in drawing 1 by B is an airborne microbe which is floating to the processed underwater one in the aerator 1 which has not adhered to the support which consists of a polyurethane foam corniform granular object A. These airborne microbes B flow back to a setting tank 11 through the reflux tubing 9 with processed water with the reflux pump 10. Moreover, raw water, such as sewage, flows into this setting tank 11 through the raw water inhalant canal 8 from the exterior. Although the processed water in an aerator 1 flows back to a setting tank 11 with an airborne microbe B with the above-mentioned reflux pump 10, the large network 14 of an eye is stretched at the inlet port of an exhaust pipe 9 so that the granular object A which is carrying out a suspension flow may not flow into biological treatment underwater in that case. This network is good anything, if a perforated plate, a slit, etc. are the things of water flow nature. Moreover, in drawing 1 , 12 is precipitate sludge which precipitated at the pars basilaris ossis occipitalis of a setting tank 11, and 13 is sludge tubing which discharges precipitate sludge 12.
[0013] As a result of processing raw water, such as sewage, by the approach of this invention, the microorganism of 15000-20000mg [/l.] thing high concentration is held at the polyurethane foam corniform granular object A, and it is accepted to be an estimate in an airborne microbe as low as the concentration of hundreds of mg/l. that raw water is extremely purified by altitude. Even if it carried out continuous running of the biological treatment equipment of this invention for one year, sludge did not fix on the front face of the film with which the hollow fiber module 2 was loaded, and the trouble which sludge eats [trouble] into the bundle of a hollow filament and skyrockets filtration resistance was not generated. Moreover, at the biological treatment process in the aerator 1 of this invention, if impurity, such as hair and a piece of vinyl, is contained in raw water, these will get twisted around the granular object A and a hollow fiber module 2, and will serve as a trouble, but in this invention, since impurity is removable by the setting tank 11 beforehand, such a trouble can be prevented.
[0014] As an example of a comparison, the microorganism support which consists of a polyurethane foam corniform granular object A is not supplied in the biological treatment tub 1. (Example 1 of a comparison) Moreover, when the concentration of the airborne microbe in an aerator is maintained [l.] in 18000mg /and

biologiçal waste treatment of raw water is performed, without making the processed water in an aerator flow back, sludge fixes on the surface of a hollow fiber. Filtration resistance of a hollow fiber went abruptly up by 1 time of frequency on about 15 - the 20th, and the sludge which adhered and fixed had to be washed to the hollow fiber, having removed the hollow fiber module 2 to whenever [the], and unfolding one 1 yarn of a hollow fiber with a help to it.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The mimetic diagram showing one example of the biological treatment equipment of this invention.
[Drawing 2] The perspective view showing one example of the granular microorganism support used for the biological treatment of this invention.
[Description of Notations]
1 Aerator
2 Hollow Fiber Module
3 Treated Water Excurrent Canal
4 Pump
5 Treated Water
6 Powder Trachea
7 Air Supply (Blower)
8 Raw Water Supply Pipe
9 Processed Water Reflux Tubing
10 Reflux Pump
11 Setting Tank
12 Precipitate Sludge
13 Sludge Tubing
14 Network
A Urethane foam corniform granular object
B Airborne microbe

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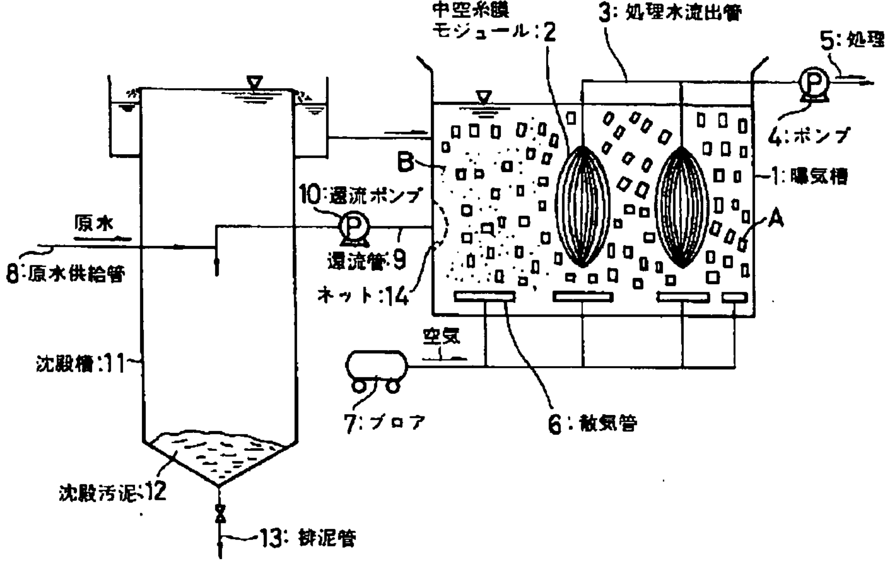
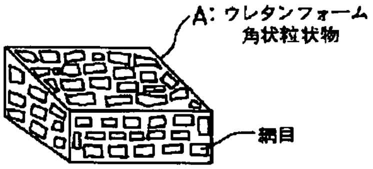
DRAWINGS

[Drawing 1]



[Drawing 2]



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